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ABSTRACT

Investigated with a sample of over 25,000 students in the second, fourth, sixth, and eighth grades was the use of the Myklebust Learning Quotient (LQ) as one basis for classifying learning disabilities. Investigated were the distribution properties of the LQ when computed on scores from the California Achievement Tests, the Comprehensive Tests of Basic Skills, and the California Test of Mental Maturity. Analysis showed that LQ distributions differed among grade levels, subject areas, and gender-by-ethnicity subgroups. The LQ distributions showed reasonable normality in many cases, but selected distributions deviated from normality. Results showed that the use of a single cutoff value, as has been recommended for selection or classification of students, is inappropriate. The results also provided normative data for the selection of variable cutoffs relative to student subgroups. (Author/IM)

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An Empirical Study of the Myklebust Learning Quotient: Unabridged Report

by

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Synopsis - Abstract

The Myklebust Learning Quotient (LQ) has been recently put forth as one basis for classifying learning disabilities. The study investigated distribution properties of the LQ when computed on scores from the California Achievement Tests, the Comprehensive Tests of Basic Skills, and the California Test of Mental Maturity. The sample contained over 25,000 students in the second, fourth, sixth, and eighth grades. Analysis showed that LQ distributions differed among grade levels, subject areas, and gender-by-ethnicity subgroups. The LQ distributions showed reasonable normality in many cases, but selected distributions deviated from normality. Results showed that the use of a single cutoff value, as has been recommended for selection or classification of students, is inappropriate. The results also provided normative data for the selection of variable cutoffs relative to student subgroups.

AN EMPIRICAL STUDY OF THE MYKLEBUST LEARNING QUOTIENT

The rapidly growing field of learning disabilities includes children with various psychological and educational developmental deficits but who have intact sensory, physical, and intellectual attributes. The newness of this field is exemplified by the diffuse number and types of definitions used to describe learning disabilities and by a wide range in the estimates of learning disability incidence among school children (Kass and Myklebust, 1969; Lerner, 1971). Although Vaughan and Hodges (1973) identified thirty-eight definitions of learning disability from a sample of one hundred practitioners in the field of special education, the typical definition cited by Vaughan and Hodges was "A child with a learning disability is any child who demonstrates discrepancy in acquiring the academic and social skills in accordance with his assessed capacity to obtain these skills."

Researchers in the field of learning disabilities indicate that learning disabled children manifest discrepancies between what they have actually learned and what they are capable of learning. Lerner (1971, pp. 62-63) implied three difficult questions concerning the above discrepancies: (1) What has the child actually learned? (2) What is the child potentially capable of learning? (3) What amount of discrepancy between achievement potential should be considered significant? Myklebust (1972) proposed the Learning Quotient (LQ), which is a ratio of

actual achievement to expected achievement, as one method of dealing with the questions raised by Lerner. The LQ, as defined by Myklebust, provides a relatively easy and objective measure of learning disability and could aid in identifying and verifying a child's eligibility for a learning disability program. However, a review of literature identified few reports that examined the properties of the LQ when applied to school populations. The purpose of the current study was to investigate the applicability of the Quotient from an empirical frame of reference.

The formula for computation of the Learning Quotient is as follows:

$$LQ = \frac{\text{actual achievement level}}{\text{expected achievement level}}, \text{ where}$$

actual achievement is a grade equivalent score for any achievement test or subtest plus 5.2, and expected achievement level is the average of the following:

chronological age,
grade level plus 5.2,
and mental age.

Grade level is the actual grade placement of a student, and mental age (MA) is either the verbal or nonverbal mental age (whichever is higher) yielded by an intelligence test. The rationale given by Myklebust (1972) was that a verbal learning

disability will be reflected in the verbal mental test score, and a nonverbal learning deficit in the nonverbal score. Hence, the higher of the two mental test scores, verbal or nonverbal, is a more accurate measure of the intellectual potential. In addition, using the higher test score overcomes the serious limitation of identifying only one type of learning disabled child, the one with verbal learning deficiencies. Chronological age (CA) is incorporated because it reflects physiological maturity. For example, the average child has the mental capacity and physical maturity required to learn to read when he reaches the age of five to six years, and he can acquire substantial facility in reading by seven to eight years of age. Grade level is included as a quantitative indicator of experience, particularly with respect to opportunity for school learning. The constant value 5.2, added to grade level, is a conversion factor which adjusts grade level to the same relative scale as MA and CA. (In situations where the school-entry age of children varies greatly, it may be advisable to compute grade conversion factors separately for groups of students.)

To date, there have been few reports of applications of the LQ in either public school settings or in research studies. In the Dallas Independent School District, the LQ is used as one means for selecting learning disabled students for resource

room services, and Myklebust and Boshes (1969) and Myklebust (1972) reported application of the LQ with third and fourth grade children in public schools. Adams, Kocsis, and Estes (1974) used the LQ to investigate the incidence of soft neurological signs in learning disabled and normal children. The researchers classified fourth graders as normal (LQ of 90 and above), border line (LQ of 85 to 89), and learning disabled (LQ below 85), but did not detect any significant neurological signs which distinguished between normal and learning disabled children.

Myklebust (1972) felt that the LQ added precision to the concept of learning disabilities by providing a basis for statistical studies in which behavioral functions could be correlated with other factors - education, psychological, and medical. Myklebust suggested that an LQ cutoff value of 90 be used as one basis for classification of a learning disability. As more attention is focused on the learning disabled child, the educator is faced with a need for an efficient means of identifying learning disabled children. Simplicity of calculation and the use of grade equivalent scores, which are readily available from standardized testing programs, would suggest that the LQ may be a useful tool for the school practitioner, as well as for the researcher. The current study investigated characteristics of LQ distributions and the extent to which these distributions approximated the theoretical

normal distribution. Of special interest was possible variation in distributions across different grade levels, subject areas, and selected student population subgroups, since this variation would affect the use and interpretation of LQ values.

PROCEDURE

The study involved the computation of Learning Quotients for approximately 25,300 students in the Dallas Independent School District, Dallas, Texas. Test scores used in the computation of LQs were from second, fourth, sixth, and eighth grade students who had participated in the District's group-administered standardized testing program during the 1973-74 school year. The District has routinely administered an achievement battery in the fall and an intelligence test in the spring of each school year.

The achievement batteries administered were the California Achievement Tests (CAT) and the Comprehensive Tests of Basic Skills (CTBS), and the intelligence test was the California Test of Mental Maturity (CTMM). Second grade students took Form A of the CAT (Level one, 1970 edition), and fourth, sixth, and eighth grade students took Form Q of the CTBS (level two at grades four and six, level three at grade eight, 1968 edition). All students took the S-Form of the CTMM (1963 edition). Level one of the CTMM was used in the second grade, level two in the fourth grade,

level two-h in the sixth grade, and level three in the eighth grade. The CAT, CTBS, and CTMM have been widely accepted and used in many school systems.

All tests given in the District's standardized testing program are group administered by classroom teachers. A faculty representative in each school building coordinates and supervises test administration, and all teachers receive orientation in standardized testing procedures. In an effort to improve testing standardization, during the 1973-74 school year (the data used in the current study), personnel from the District's Research and Evaluation Department observed classrooms during the fall achievement testing. All schools received advance notice that these personnel would be observing classes on a "random" sample basis. Results from fall semester observations indicated that teachers had followed standardized procedures in test administration, but there were no observations of intelligence testing in the spring semester.

In order to ensure that sampled students possessed a reasonable degree of intellectual integrity the sample included only those students whose verbal or nonverbal intelligence quotient was greater than 90. This restriction eliminated about 29 percent of the available student sample. The above restriction seemed appropriate in view of the common agreement that a learning disability classification assumes a degree of intellectual integrity.

The computation of Learning Quotients followed the procedures specified by Myklebust (1972) and previously outlined in this report. Grade level and chronological age were computed for the date of achievement testing, October, 1973. Mental age was derived from the verbal or nonverbal intelligence quotient, depending on which was greater, and was derived for the date of intelligence testing, April, 1974. Although the administration of achievement and intelligence tests on different dates involved two different chronological ages, the computation of expected achievement level for the LQ used the chronological age at date of achievement testing. All achievement grade level scores were based on large-city school norms rather than national norms. Computer programs, written by the first author, created the necessary computer data files and executed the desired quantitative operations.

Prior to analysis of LQ distributions, a visual inspection of frequency distributions of LQs for each grade and subtest was made in order to check for possible outlyers, that is, Quotients grossly divergent from the population of reasonable values. A very small percent of outlyers was detected at each grade level, and these were excluded from further analysis. Inspection of computer data files revealed that entries such as erroneous birth dates had created the outlyers.

RESULTS

Data analysis consisted of the computation of the mean, standard deviation, skewness, and kurtosis of each LQ distribution. Equations for the mean and variance are well known. Skewness may be expressed by

$$\text{skewness} = \frac{\sum_{i=1}^{N} (X_i - \overline{X})^3/N}{s^3},$$ where $\overline{X}$ is

the raw score mean, X_i is the _ith_ raw score, and s is the standard deviation of N raw scores. Kurtosis may be expressed similarly by

$$\text{kurtosis} = \frac{\sum_{i=1}^{N} (X_i - \overline{X})^4/N}{s^4} - 3.$$

The mean and standard deviation permitted the desired comparisons among LQ distributions relative to central tendency and variability. Skewness and kurtosis permitted comparison of LQ distributions to the theoretical normal distribution, which has skewness and kurtosis equal to zero. Interpretation of skewness and kurtosis values assumes that distributions are unimodel in form, and prior visual inspection of LQ distributions showed that all distributions were unimodel.

Positive skewness indicates that scores in the right-hand tail of the skewed distribution tend to be more extreme than

scores in the right-hand tail of the normal distribution. Positive kurtosis indicates that the frequency of one or more scores relative to other scores (i.e., the height of the distribution curve) is greater than that of the normal distribution. Values of skewness usually range from -3.00 to +3.00, and the smallest possible value of kurtosis is -3.00. However, positive values of kurtosis may be large, depending on the form of a given distribution. The reader may refer to Ghiselli (1964, pp. 57-58) for a limited graphic presentation of skewness and kurtosis values relative to the theoretical normal distribution.

Table 1 presents the results of analysis of LQ distributions for total samples at all grade levels. The most obvious finding was the lack of uniformity among LQ distributions. Mean LQ ranged from a maximum of 100.72 for the CTBS reading subtest of sixth graders to a minimum of 91.42 for the CTBS math subtest of fourth graders. The standard deviations range from 15.93 for the CTBS language subtest of sixth graders to 9.17 for the CAT math subtest of second graders. Although means and standard deviations varied across grade levels, the reading and language subtest LQs showed comparable means and standard deviations within grade levels. The math subtest yielded the smallest mean LQ and standard deviation at all grade levels.

Insert Table 1 About Here

Skewness and kurtosis values (Table 1) show that most LQ distributions for total grade samples reasonably approximated the normal distribution, except for the CAT language subtest of second graders and the CTBS math subtest of fourth graders. The LQ distributions in the sixth and eighth grades approximated the normal distribution more closely than those in the second and fourth grades.

Analysis of LQ distributions for gender-by-ethnicity student subgroups within grade levels revealed even further heterogeneity among LQ distributions. Tables 2 through 5 present the results of analysis for each of the four grades. Mean LQ ranged from a maximum of 107.03 for the CTBS language subtest of female Anglo sixth graders to a minimum of 83.44 for the CTBS math subtest of male Black eighth graders. Female Anglo students had the highest mean LQ for all subtests at all grade levels, and male Anglo students had the next highest mean LQ. While the mean LQs of Black and Mexican-American students were generally comparable for all subtests at all grade levels, Mexican-American students (with only one exception) had the highest mean LQ within each gender. In addition, the mean LQs of female students (with one exception) were higher than male students within all ethnic groups for all subtests at all grade levels. One should note that the above patterns were less pronounced in LQ distributions based on math subtest scores than on reading and language subtest scores.

Insert Tables 2 - 5 About Here

Inspection of LQ standard deviations reported in Tables 2 through 5 shows that Anglo students had a larger standard deviation for all subtests at all grade levels, except the eighth grade where the CTBS reading and language subtests of Black students had the largest standard deviations. In most cases, the standard deviation of LQs for Black and Mexican-American students were nearly equal. In grades two, four, and six, the standard deviations of math subtest LQs were generally less than those of the reading and language subtests.

Skewness and kurtosis values presented in Tables 2 through 5 show that LQ distributions were approximately normal within gender-by-ethnicity student subgroups for most subtests and grade levels. The LQ distributions were more nearly normal at grades six and eight than at grades two and four.

As previously noted, the distributions of CAT language subtest LQs of all second graders and the CTBS math subtest LQs of all fourth graders showed considerable deviation from the theoretical normal distribution (Table 1). Skewness and kurtosis values reported in Table 2 show that Black students and, to a lesser degree, Mexican-American students, predominantly contributed to the nor-normality of CTBS math subtest LQs. Similar values from Table 3

show that Mexican-American students, and to a lesser degree, Black students, predominantly contributed to the nonnormality of CTBS math subtest LQS.

DISCUSSION OF RESULTS

The data show that the LQ distributions varied as a function of subtest, grade level, and gender-by-ethnicity subgroup, all of which present an obvious difficulty in the use of the LQ as a screening device for school populations. As might be expected, LQ distributions reflected group differences inherent in many standardized achievement and intelligence tests. It is well known that female students exhibit better reading achievement than males and that Anglo students generally perform better on standardized tests than do students of other ethnic backgrounds.

Recent developments in selection procedures and test fairness have pointed to a need for variable cutoffs in order to achieve fair selection for members of population subgroups (Flaugher, 1974). The results of the current study clearly show that no single cutoff value would be appropriate for all subtests, grade levels, and student gender-by-ethnicity subgroups. For example, if the cutoff value for selecting students was computed as the mean minus one standard deviation, the CTBS reading subtest cutoff LQ for the total eighth grade sample would be 84.18 (98.14 - 13.96 = 84.18, Table 1). However, a cutoff of 84.18 would result in a very

disproportionate selection of male Black and Mexican-American eighth graders since the mean LQs for these students were 86.71 and 87.90, respectively (Table 5).

Thorndike (1971) suggested a selection model in which the actual success rate for each population subgroup determines the cutoff value for each subgroup. In the Thorndike model, the percent selected from each subgroup is equal to the percent who succeed (success rate) from each group. In the case of learning disabilities, the success rate would be the percent of students with an actual or potential learning disability, that is, those who "succeed" at having a disability. For example, if the incidence of learning disabilities among eighth grade male Anglo students were known to be 12 percent and if the incidence among second grade female Mexican-American students were known to be 6 percent, one would select an LQ cutoff value for each group that would identify 12 and 6 percent of the respective groups.

While the LQ may be a valuable tool for the identification of potential learning disabilities, efficient use of the LQ as a screening device in school populations requires the use of variable cutoff values. Such a procedure assumes two prerequisites. First, the percents of students to be selected from each subgroup must be known. Second, the forms of the LQ distributions must be known for each test, grade level, and student subgroup.

Learning disability research provides little basis for the determination of appropriate percents of students to be selected. At the present time, variability among definitions of learning disability has led to disagreement about the incidence of learning disability in the total population (Lerner, 1971, pp. 10-11), and there have apparently been few studies, if any, to determine learning disability incidence among specific population subgroups. However, there is indication that the incidence is greater among male students than females (Gruenberg, 1964), and there is emerging evidence of differential psycholinguistic patterns among different ethnic groups (Kirk, 1972). Perhaps the best way to meet the first prerequisite is to specify arbitrarily the percents of students to be selected. The arbitrary specification of percents could be made in relation to available research (one might wish to select more males than females) and in relation to a particular screening philosophy (one might wish to over-select as a conservative procedure).

The second prerequisite, knowledge about the forms of the LQ distributions, also presents a difficult situation since there is little available normative data regarding LQ distributions. Without normative data, there is no basis for determining the percent of a population selected by any given cutoff value. The current study showed that LQ distributions may deviate considerably, in

select cases, from the normal distribution. It is well known that a cutoff value computed as the mean minus one standard deviation will select about 16 percent of the normal distribution, but deviation from normality affects the percent identified by such a cutoff. For example, a cutoff computed as the mean minus one standard deviation would select about 16 percent of male Mexican-American eighth graders on the CTBS language subtest (Table 5) but would not select 16 percent of male Black second graders on the same subtest (Table 2), since the latter distribution shows gross deviation from normality.

The review of literature identified only one other report which could provide a norm reference for the LQ. Myklebust (1972) reported LQ means and standard deviations for the reading, spelling, and arithmetic subtests based on Metropolitan Achievement Test (MAT) scores of 932 third and fourth graders. Students in Myklebust's sample were from a middle to upper class economic area where there was a minimum of cultural deprivation. Mean verbal and nonverbal intelligence quotients, as measured by Thurstone's Primary Mental Abilities Test, were 110 and 106, respectively. Table 6 presents LQ means and standard deviations as reported by Myklebust. It is interesting to note that the MAT arithmetic subtest yielded the lowest mean LQ and the smallest standard deviation as was the case for the CTBS and CAT math subtests (Table 1) in the

current study. At the present time, there is little basis for determining the comparability of LQs computed on scores from different standardized tests.

Insert Table 6 About Here

It is important to note that the current study did not investigate the validity of the LQ as a measure of learning disability. A review of literature revealed only limited information on the validity of the LQ. Myklebust (1971) reported that the LQ was positively related to scores on the Myklebust Pupil Rating Scale, a checklist to identify learning problems among children. Myklebust and Boshes (1969) found that 15 percent of a large sample of third and fourth graders obtained an LQ of less than 90 and that about one-half of those identified exhibited evidence of a learning disability. Myklebust (1972) also found that an LQ cutoff of 90 identified about 15 percent of a sample of third and fourth graders but that only about one-fourth of those identified showed evidence of neurogenic learning disorders. There is clearly a need for more research to investigate the construct and criterion validity of the LQ. Research into construct validity should give due consideration to operational definitions of learning disability, such as that reported by Estes and Huizinga (1974).

One probable limitation to LQ validity is the inclusion of grade equivalent scores in computation of the Quotient. The many undesirable psychometric features of grade equivalent scores are well known (Durost, 1962, pp. 63-69), and these could easily limit LQ validity. Perhaps the two most pejorative features of the grade equivalent score are its independence of raw score variance and the determination of extreme grade equivalent scores through extrapolation. In the extreme ends of score distributions, a difference of only one raw score unit can alter the grade equivalent score by one or even more than one grade level. Such a condition could negatively affect the validity of the LQ, since a difference of one raw score unit on an achievement test (which yields the grade equivalent score for the LQ numerator) could significantly affect the absolute value of the LQ. Test publishers have recently developed growth scales in order to eliminate many of the problems associated with grade equivalent scores (Science Research Associates, 1972), and efforts in validating the LQ may need to consider these or other alternative scales in place of grade equivalents.

In LQ validity studies, it may also be advisable to modify the intelligence quotient standard for acceptable intellectual integrity. The current study included only those students whose intelligence quotient (either verbal or nonverbal) was greater

than 90, but it is well known that intelligence tests contain cultural biases relative to minority racial groups. Consequently, the use of lower intelligence quotient limits for minority students would probably not impair the degree of intellectual integrity within the sample and would increase the representativeness of the sample.

The LQ may be viewed as a measure of discrepant achievement and is directly related to the more general issue of selecting under- and over-achievers. The discrepant achiever may be defined as any student who achieves at a level under or above his expected or predicted achievement level. In the case of learning disabilities, the discrepancy is one of underachievement.

Research in discrepant achievement has yielded a variety of methodological procedures and conflicting results (Asbury, 1974). Farquhar and Payne (1964) compared seven typical techniques used in selecting discrepant achievers and found little agreement in terms of the numbers and kinds of students selected. Reported research showed only limited use of ratio statistics for the selection of discrepant achievers (Mayo, 1961), and there is little basis for conjecture about the relationship of the LQ to other measures of discrepant achievement. It may be useful to investigate these relationships in further LQ research.

LD STUDY - BAKER

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Table 1

Characteristics of LQ Distributions

for Total Samples at all Grade Levels

Grade	Subtest	N	Mean	SD	Skewness	Kurtosis	Range[1]
Two (CAT)	Reading	6471	96.45	13.67	0.74	0.58	64-156
	Language	6380	95.52	14.18	1.10	1.62	62-168
	Math	6524	92.98	9.17	0.20	-0.11	64-128
Four (CTBS)	Reading	7135	95.38	15.43	0.11	0.37	49-164
	Language	7062	92.59	14.67	0.27	0.50	53-161
	Math	7050	91.42	9.46	-0.35	1.82	53-136
Six (CTBS)	Reading	6430	100.72	15.31	0.00	-0.20	48-159
	Language	6407	99.40	15.93	0.09	-0.39	50-149
	Math	6402	94.47	10.99	0.21	-0.09	52-131
Eight (CTBS)	Reading	5247	98.14	13.96	-0.43	-0.06	42-136
	Language	5249	96.92	15.07	-0.24	-0.38	45-139
	Math	5120	92.09	12.83	0.01	-0.48	46-135

[1] In Table 1 through 5, LQ values reported on the range column are rounded to the nearest whole number.

Table 2

Characteristics of LQ Distributions Based on CAT Scores

for Student Subgroups in Grade Four

Subtest	Subgroup[1]	N	Mean	S.D.	Skewness	Kurtosis	Range
Reading	M-A	1584	99.57	13.89	0.66	0.38	67-149
	M-B	1216	89.30	10.14	0.89	1.93	68-156
	M-MA	452	90.14	10.89	0.81	1.24	67-135
	F-A	1530	104.57	14.03	0.37	0.04	64-156
	F-B	1241	92.95	11.16	0.70	1.17	69-145
	F-MA	448	93.18	10.89	0.60	0.84	70-135
Language	M-A	1555	99.33	14.39	0.97	1.14	68-164
	M-B	1191	87.76	9.29	1.27	3.95	67-145
	M-MA	440	88.42	9.50	0.79	1.94	62-136
	F-A	1520	104.59	15.17	0.76	0.59	64-168
	F-B	1235	90.78	10.63	1.10	3.17	65-162
	F-MA	439	92.08	11.23	0.91	1.65	69-146
Math	M-A	1589	95.55	9.42	0.19	-0.10	70-125
	M-B	1231	88.80	8.34	0.46	-0.03	67-121
	M-MA	461	90.89	8.08	-0.09	-0.15	64-113
	F-A	1538	96.75	8.60	0.00	0.18	65-128
	F-B	1254	90.40	8.17	0.10	-0.33	67-118
	F-MA	451	91.85	8.08	0.07	0.11	68-120

[1] Student subgroup identifiers are as follows: M-A = Male Anglo, M-B = Male Black, M-MA = Male Mexican-American, F-A = Female Anglo, F-B = Female Black, and F-MA = Female Mexican American.

Table 3

Characteristics of LQ Distributions Based on CTBS Scores

Student Subgroups in Grade Four

Subtest	Subgroup[1]	N	Mean	SD	Skewness	Kurtosis	Range
Reading	M-A	1925	99.99	15.52	0.12	0.60	49-164
	M-B	1169	85.76	12.49	-0.23	0.56	53-139
	M-MA	401	89.76	13.40	-0.14	0.27	55-127
	F-A	1955	102.90	14.18	-0.11	0.51	55-150
	F-B	1309	89.25	12.22	-0.24	0.48	55-135
	F-MA	376	90.02	12.55	-0.08	0.74	56-135
Language	M-A	1901	94.20	14.93	0.24	0.54	54-148
	M-B	1157	83.89	11.30	-0.13	0.06	53-121
	M-MA	396	87.25	13.39	-0.07	-0.01	55-128
	F-A	1931	100.25	14.57	0.11	0.53	56-161
	F-B	1304	88.77	11.62	-0.08	0.34	57-133
	F-MA	373	90.75	12.21	0.02	0.69	55-132
Math	M-A	1909	93.82	9.74	0.00	1.29	56-136
	M-B	1146	87.12	9.04	-1.13	1.80	53-117
	M-MA	399	90.11	9.23	-0.77	2.30	56-120
	F-A	1936	94.12	8.69	-0.19	1.38	57-125
	F-B	1291	88.54	8.40	-0.95	2.16	57-114
	F-MA	369	89.64	8.55	-0.48	3.26	53-128

[1]See Table 2.

Characteristics of LQ Distributions Based on CTBS Scores

Student Subgroups in Grade Six

Subtest	Subgroup[1]	N	Mean	SD	Skewness	Kurtosis	Range
Reading	M-A	2050	104.13	15.11	-0.19	-0.18	50-153
	M-B	810	89.94	13.88	0.21	0.46	48-146
	M-MA	296	91.94	13.25	0.12	0.22	51-129
	F-A	2020	106.97	13.55	-0.05	-0.11	56-159
	F-B	952	93.39	12.18	0.15	0.42	54-138
	F-MA	302	96.38	11.88	0.18	0.37	62-132
Language	M-A	2044	99.36	16.05	0.13	-0.57	53-149
	M-B	802	87.93	13.47	0.36	0.40	50-133
	M-MA	295	90.65	13.17	0.03	0.24	50-128
	F-A	2016	107.03	14.42	-0.07	-0.37	60-147
	F-B	947	95.84	13.39	0.11	0.17	50-134
	F-MA	303	98.87	13.56	0.01	0.10	58-136
Math	M-A	2043	96.76	11.72	0.13	-0.38	63-131
	M-B	801	87.89	9.27	0.17	-0.25	64-120
	M-MA	300	89.96	9.82	0.31	0.29	63-124
	F-A	2014	97.83	10.07	0.14	-0.02	64-131
	F-B	941	89.95	8.76	0.10	0.12	63-127
	F-MA	303	92.72	9.11	-0.14	1.18	52-119

[1]See Table 2.

Table 5

Characteristics of LQ Distributions Based on CTBS Scores

Student Subgroups in Grade Eight

Subtest	Subgroup[1]	N	Mean	SD	Skewness	Kurtosis	Range
Reading	M-A	1878	100.89	13.21	-0.56	0.33	43-133
	M-B	504	86.71	13.97	0.01	-0.21	45-130
	M-MA	222	87.90	12.22	-0.27	-0.15	50-116
	F-A	1845	102.95	11.67	-0.51	0.33	61-136
	F-B	579	90.59	12.47	-0.18	-0.01	42-126
	F-MA	219	90.82	12.06	-0.17	-0.20	53-119
Language	M-A	1879	95.32	14.63	-0.13	-0.34	49-138
	M-B	506	84.70	13.98	0.20	-0.07	45-132
	M-MA	223	86.81	13.30	0.09	-0.07	51-123
	F-A	1845	104.05	12.73	-0.45	0.13	57-136
	F-B	577	94.89	13.92	-0.13	-0.34	58-139
	F-MA	219	94.47	13.58	-0.14	-0.42	59-125
Math	M-A	1841	93.51	13.02	-0.04	-0.45	55-135
	M-B	489	83.44	10.92	0.59	0.72	57-132
	M-MA	214	85.50	11.89	0.45	-0.27	62-121
	F-A	1806	95.90	11.91	-0.26	-0.34	51-134
	F-B	554	86.78	10.61	0.08	0.27	46-118
	F-MA	216	87.92	11.57	0.25	0.30	59-130

[1]See Table 2.

Table 6

Learning Quotients Derived from

Metropolitan Achievement Test

as Reported by Myklebust

	LQ	
	Mean	SD
Word Discrimination	110	10.9
Word Knowledge	110	9.8
Comprehension	107	12.9
Spelling	115	13.2
Arithmetic	104	9.5